

MISSION DATA BASE FOR LOW COST MISSIONS
TO SMALL BODIES IN THE SOLAR SYSTEM*

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ABSTRACT

Proposals to conduct low cost deep space missions of short duration to small bodies will concentrate on the near-Earth asteroids (NEA) and comets. Design of such missions first requires that preliminary mission and spacecraft designs be performed to determine feasibility. This is referred to as a Phase A study. In the mission design portion of this study, the following tasks are usually necessary:

1. Search for the trajectory mode (direct, gravity assist, etc.) that best satisfies energy, flight time, and other major requirements.
2. Perform some trajectory analysis at Earth and the target body(s), to see if conditions are compatible with spacecraft, science, and operations requirements and constraints.
3. Select the best suited trajectory mode and develop the launch period.
4. Generate parametric data useful for spacecraft and instrument designs, and navigation and operations processes.
5. Develop preliminary sequence data to verify that all activity in actual performance, will be consistent with all capabilities and constraints. This provides the final measure of mission success.

Unlike missions to the planets, whose orbits are nearly circular and in the ecliptic, missions to asteroids and comets are complex, and not very cyclical. That is, the synodic period is of little value in predicting when the next favorable launch opportunity will occur. The solution offered here is the development of a mission design data base. That is, the desirable mission data for a suitable launch period (20 years, for example) and for each asteroid would be generated and stored in a data base, and made accessible to anyone instructed in the use of this data base. Storage would be on a microcomputer, and software would be written to provide searches based on the user requirements.

The data base would include the JPL Dastcom3 file so that searches on desired asteroid physical or orbital characteristics can be made. Then, the mission data may be accessed, by first looking at the launch and arrival date regions for which energy to perform a specific type of mission is a minimum. (The types of missions considered at this time are flybys, rendezvous, anti sample return.) Within this launch-arrival space, other parameters of interest in a Phase A study would be generated. It is important that data around the minimum energy solution be available, so that the user may move to a non-optimum solution if he has specific constraints or requirements. There are about 2 dozen such parameters which would be available to the user, and this number can be increased if necessary.

This first version of the small bodies database will include NEA and comet missions only. It will be updated periodically to include newly discovered bodies and those whose orbits have been better determined. A later version will include the main belt asteroids and other bodies in the solar system, and multiple body encounters.

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